# APPENDIX A
# STORMWATER COMPOSITE SAMPLING SOP

# STORMWATER SAMPLING AND PROCESSING

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting flow weighted composite stormwater samples from freshwater environments using an ISCO automatic sampler.

This SOP utilizes and augments the procedures outlined in the San Francisco Estuary Institute's Field Sampling Manual for the Regional Monitoring Program for Trace Substances (David et al. 2001), the Interagency Field Manual for the Collection of Water-Quality Data (USGS 2000), and U.S. Environmental Protection Agency (EPA) Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (EPA 1996). A goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow EPA guidelines.

While sampling for trace metals, trace clean sampling techniques will be used for the collection of unfiltered organic compounds and conventionals, such as total suspended solids, dissolved organic carbon, and dissolved suspended solids. By following this SOP, the collection of other samples besides trace metals guarantees a high level of sample integrity and minimizes contamination during sample handling.

# SUMMARY OF METHOD

Stormwater samples for standard chemical and conventional analyses will be collected using an automatic sampler that uses a peristaltic pump with a sampling tube fixed in the outlet of the catch basin.

Samples are collected from the sampler using the two-person "clean hands – dirty hands" method (EPA 1996). Samples will be transported to the LWG Field Laboratory, where they will be further composited. Following sample compositing in the mixing containers, appropriate sample bottles, with preservative, if applicable, are filled using a peristaltic pump. The sample containers are capped, labeled, and placed in clean, double Ziploc™ bags, and then placed inside a cooler for transport to the analytical laboratory.

# SUPPLIES AND EQUIPMENT

The general types of equipment that are required are described in this section. A detailed supply and equipment list is provided in Table 1-1 [to be completed]. Additional equipment may be required depending on the sample site.

An ISCO Model 6712 automated sampler unit will be deployed at each sampling location. The sampler will be equipped with glass sample bottles and a Teflon screen and sampling tube. Each sampler will be equipped with a cellular modem and area/velocity type flow meter. Additionally, a minimum 50 amp hour GSM deep cycle battery, stainless steel mounting brackets will be used to mount the flow sensor and sampling tube and hang the battery and sampler in the catch basin

# PROCEDURES

## EQUIPMENT DECONTAMINATION

Each sampling team is responsible for preparing their equipment prior to the sampling event. Pre-designated commercial laboratories will decontaminate sample tubing, mixing containers, and sampling bottles according to their specific SOPs.

Although it is anticipated that the sampling teams will get their supplies "Certified Clean" from designated laboratories, the following procedures are included for reference.

**Teledyne Isco Glass Sample Bottles**

- One spectro-grade acetone rinse.
- Dishwasher cycle (wash and tap water rinse, no detergent).
- Acid wash with at least 20 percent hydrochloric acid.
- Dishwasher cycle (wash and tap water rinse, no detergent).
- Replace in covered Teledyne Isco tubs.

**Teflon Suction Line**

- Rinse twice with spectro-grade acetone.
- Rinse thoroughly with hot tap water using a brush, if possible, to remove particulate matter and surface film.
- Rinse thoroughly three times with tap water.
- Acid wash with at least 20 percent hydrochloric acid.
- Rinse thoroughly three times with tap water.
- Rinse thoroughly three times with distilled water.
- Rinse thoroughly with petroleum ether and dry by pulling air through the line.
- Dry overnight in a warm oven (use an oven temperature of lower than 150° F), if possible.
- Cap ends with aluminum foil.

**Teledyne Isco Pump Tube**

- Rinse by pumping hot tap water through the tube for at least 2 minutes.

- Acid wash the tube by pumping at least a 20 percent solution of hydrochloric acid through the tube for at least 2 minutes.
- Rinse by pumping hot tap water through the tube for at least 2 minutes.
- Rinse by pumping distilled water through the tube for at least 2 minutes.

## STORMWATER SAMPLE COLLECTION

### Clean Hands/Dirty Hands Technique

Clean hands/dirty hands technique requires two or more people working together. At the field site, one person is designated as "clean hands" (CH) and a second person as "dirty hands" (DH). Although specific tasks are assigned at the start to CH or DH, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both CH and DH wear appropriate non-contaminating, disposable, powderless, nitrile gloves during the entire sampling operation and change gloves frequently, usually with each change in task (wearing multiple layers of gloves allows rapid glove changes).

CH takes care of all operations that involve equipment that comes into contact with the sample, and under the covered portions of the automatic sampler including the following responsibilities:

- Handles the stormwater sample bottles (removes and replaces)
- Handles sample bottles until they are placed and sealed into ZipLoc bags
- Prepares a clean workspace in LWG Field Laboratory
- Sets the equipment (i.e., the sample bottles and the filtration and preservation equipment) inside the laboratory

DH takes care of all operations that involve contact with potential sources of contamination, including the following responsibilities:

- Works exclusively exterior to the samplers
- Removes samplers from catch basins, if necessary, and releases catches and lifts of sampler cover for CH.
- Replaces cover and latches sampler covers
- Handles the tools, such as hammers, wrenches, keys, and locks
- Handles the single or multi-parameter instruments for field measurements.

- Sets up and checks the field-measurement instruments
- Measures and records the water depths and field measurements.
- Packs sealed bags with samples into coolers and seals coolers.

### Stormwater Sampling Procedures

Two persons are needed to conduct the sampling and a third person to keep track of sample logging and sample processing as well as assisting with lifting the sampler in and out of the catch basin. In addition, the third person may be responsible for taking stormwater parameters.

The following procedures will be followed when collecting the water samples from the Isco samplers:

While the DH person and assistant remove the manhole or catch basin lid, the CH person will clear a work space and lay down a plastic sheet. The DH person will place the sampler on the plastic sheeting and release the catches on the sampler and lift away the cover standing it on the plastic sheeting. The CH person will inspect the inside of the sampler for signs of wear or debris. The CH person will then install Teflon lined caps on each of the sample bottles. The CH person will remove each sample bottle in turn, and then label and seal the sample bottle in Ziploc bag.

After the samples have been processed, the CH person installs new "Certified Clean" sample bottles in the sampler. The DH person will replace the cover and latch the fasteners. The DH person and assist and will replace sampler in the catch basin and close and lock the lid if applicable.

## SAMPLE PROCESSING

Once a stormwater sample container is properly closed, labeled, and then sealed inside a Ziploc™ bag by the CH person, the DH person seals the second Ziploc™ bag and places it inside a large plastic bag, which in turn is placed inside a cooler containing wet ice.

All samples are stored in sealed coolers with wet ice and transferred to the LWG Field Laboratory at the conclusion of the sampling event. Personnel will then transfer the samples to the laboratory. The field leader is responsible for maintaining sample integrity throughout the event. Once at the field lab, sample contamination is avoided by handling the double-bagged sample containers with clean gloves, and transferring the samples into clean refrigerators immediately after samples are brought back from the field.

### Storage Temperature Quality Control

Each storage freezer or refrigeration unit is monitored daily to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

## FIELD QUALITY CONTROL PROCEDURES

Field QC samples that may be collected during sampling are the same as for any field sampling program. The types and frequency of field QC sample collection are project-specific QC samples are described below (USGS 2000): and will be described in the FSP. The most commonly collected field QC samples are as follows.

**Field Blank.** A field blank is a sample of analyte-free water that is supplied by the laboratory. The field blank is generated by transferring the analyte-free water to another laboratory-supplied sample container while at the field sampling location. Field blank results are used to measure and document any possible onsite contamination.

**Decon Blank**. Prior to the start of sample collection activities for each sampling event, a decon blank will be generated by the laboratory that conducts decontamination of the peristaltic pump sampling equipment to ensure that the decontamination procedure is adequate.

**Field Split Sample.** A field split sample consists of aliquots of the same composited stormwater sample that are equally distributed in two sets of sample containers. These samples may be analyzed identically or analyzed by different laboratories to evaluate repeatability of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.

**Field Replicate.** A field replicate consists of a second sample that is collected using the same sampling methodology used to obtain the first sample. It is collected at the same sampling location and as soon after the original sample as possible. Analysis of the field replicate allows evaluation of the repeatability of field sampling methodologies, as well as the heterogeneity of the sample matrix. Statistical analysis of multiple replicates may also be used to calculate the likely range of an analyte concentration at a given sampling location.

## REFERENCES

David, N., D. Bell, and J. Gold. 2001. Field Sampling Manual for the Regional Monitoring Program for Trace Substances. San Francisco Estuarine Institute, San Francisco, CA.

Integral. 2004. QAPP Addendum for Stormwater Sampling. Prepared for the Lower Willamette Group, Portland, OR. Integral Consulting, Inc., Mercer Island, WA.

EPA. 1996. Method 1669 - Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC.

USGS. 2000. Interagency Field Manual for the Collection of Water-Quality Data. Open-File Report 00–213. U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency. Austin, TX.

# APPENDIX B
# STORMWATER GRAB SAMPLING SOP

# STORMWATER SAMPLING AND PROCESSING

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting stormwater samples from freshwater environments using a peristaltic pump and Teflon™ tubing.

This SOP utilizes and augments the procedures outlined in the San Francisco Estuary Institute's Field Sampling Manual for the Regional Monitoring Program for Trace Substances (David et al. 2001), the Interagency Field Manual for the Collection of Water-Quality Data (USGS 2000), and U.S. Environmental Protection Agency (EPA) Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (EPA 1996). A goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow EPA guidelines.

While sampling for trace metals, trace clean sampling techniques will be used for the collection of unfiltered organic compounds and conventionals, such as total suspended solids, dissolved organic carbon, and dissolved suspended solids. By following this SOP, the collection of other samples besides trace metals guarantees a high level of sample integrity and minimizes contamination during sample handling.

# SUMMARY OF METHOD

Stormwater samples for standard chemical and conventional analyses will be collected using the peristaltic pump in the Isco automatic sampler deployed at the sampling site.

Samples are collected using the two-person "clean hands – dirty hands" method (EPA 1996). The Isco sampler will be removed for the catch basin and the cover will be removed by the DH person. The distribution tube will be removed from the bulkhead fitting by the CH person. The CH person will attach a Teflon tube to distribute water to sample containers. The DH person will suspend the program running on the sampler and activate the grab sample feature. The DH will enter the volume of sample desired on the sample screen. The sampler will be activated and purge itself several times and pause before delivering the grab sample.

The CH person will hold and direct the flow from the pump into the "Certified Clean" sample containers. The sample containers are capped, labeled, and placed in clean, double Ziploc™ bags, and then placed inside a cooler for transport to the LWG Field Laboratory.

# SUPPLIES AND EQUIPMENT

The general types of equipment that are required are described in this section. A detailed supply and equipment list is provided in Table 1-1. Additional equipment may be required depending on the project.

It is assume that the grab samples will be collected with the peristaltic pumps built into the Isco sampler deployed at sampling site. Only sampling containers and a short length of Teflon tubing will be required to collect the samples.

# PROCEDURES

## EQUIPMENT DECONTAMINATION

Each sampling team is responsible for preparing their equipment prior to the sampling event. Pre-designated commercial laboratories will decontaminate sample tubing, mixing containers, and sampling jars according to their specific SOPs.

### Stormwater Sampling Equipment Preparation

It is assumed that the sampling team will com prepared with “Certified Clean” sample bottles and apparatus to collect the grab samples.

## STORMWATER SAMPLE COLLECTION

Clean hands/dirty hands technique requires two or more people working together. At the field site, one person is designated as "clean hands" (CH) and a second person as "dirty hands" (DH). Although specific tasks are assigned at the start to CH or DH, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both CH and DH wear appropriate non-contaminating, disposable, powderless, nitrile gloves during the entire sampling operation and change gloves frequently, usually with each change in task (wearing multiple layers of gloves allows rapid glove changes).

CH takes care of all operations that involve equipment that comes into contact with the sample, and under the covered portions of the automatic sampler including the following responsibilities:

- Handles the stormwater sample bottles (removes and replaces)
- Handles sample bottles until they are placed and sealed into ZipLoc bags
- Prepares a clean workspace in LWG Field Laboratory
- Sets the equipment (i.e., the sample bottles and the filtration and preservation equipment) inside the laboratory

DH takes care of all operations that involve contact with potential sources of contamination, including the following responsibilities:

- Works exclusively exterior to the samplers
- Removes samplers from catch basins, if necessary, and releases catches and lifts of sampler cover for CH.
- Replaces cover and latches sampler covers
- Handles the tools, such as hammers, wrenches, keys, and locks
- Handles the single or multi-parameter instruments for field measurements.
- Sets up and checks the field-measurement instruments
- Measures and records the water depths and field measurements.
- Packs sealed bags with samples into coolers and seals coolers.

## Stormwater Sampling Procedures

Two persons are needed to conduct the sampling and a third person to keep track of sample logging and sample processing as well as assisting with lifting the sampler in and out of the catch basin. In addition, the third person may be responsible for taking stormwater parameters.

The following procedures will be followed when collecting the water samples from the Isco samplers:

While the DH person and assistant remove the manhole or catch basin lid, the CH person will clear a work space and lay down a plastic sheet. The DH person will place the sampler on the plastic sheeting and release the catches on the sampler and lift away the cover standing it on the plastic sheeting. The CH person will inspect the inside of the sampler for signs of wear or debris. The CH person will then remove the distribution line form the bulkhead fitting and install a Teflon line.

The DH or assistant will re-glove to operate the Isco sampler. The program running on the Isco sampler will be interrupted and the sampler placed into "Grab" mode. The DH person shall program the volume of water desired and start the sampler. The sampler will purge the lines several times and pause before delivering the sample.

The CH person will direct the flow of water into the sample containers. When complete the CH person will then label and seal the sample bottle in Ziploc bag. Once the samples have been properly secured, the CH person will the sampling tube and reattach the distribution tube to the bulk head fitting and return the sampler to standby mode.

The DH person will replace the cover and latch the fasteners. The DH person and assistant will replace sampler in the catch basin and close and lock the lid if applicable.

## SAMPLE PROCESSING

Once a stormwater sample container is properly closed, labeled, and then sealed inside a Ziploc™ bag by the CH person, the DH person seals the second Ziploc™ bag and places it inside a large plastic bag, which in turn is placed inside a cooler containing wet ice.

All samples are stored in sealed coolers with wet ice and transferred to the LWG Field Laboratory at the conclusion of the sampling event. Personnel will then transfer the samples to the laboratory. The field leader is responsible for maintaining sample integrity throughout the event. Once at the field lab, sample contamination is avoided by handling the double-bagged sample containers with clean gloves, and transferring the samples into clean refrigerators immediately after samples are brought back from the field.

### Storage Temperature Quality Control

Each storage freezer or refrigeration unit is monitored daily to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

## FIELD QUALITY CONTROL PROCEDURES

Field QC samples that may be collected during sampling are the same as for any field sampling program. The types and frequency of field QC sample collection are project-specific QC samples are described below (USGS 2000): and will be described in the FSP. The most commonly collected field QC samples are as follows.

**Field Blank.** A field blank is a sample of analyte-free water that is supplied by the laboratory. The field blank is generated by transferring the analyte-free water to another laboratory-supplied sample container while at the field sampling location. Field blank results are used to measure and document any possible onsite contamination.

**Decon Blank**. Prior to the start of sample collection activities for each sampling event, a decon blank will be generated by the laboratory that conducts decontamination of the peristaltic pump sampling equipment to ensure that the decontamination procedure is adequate.

**Field Split Sample.** A field split sample consists of aliquots of the same composited stormwater sample that are equally distributed in two sets of sample containers. These samples may be analyzed identically or analyzed by different laboratories to evaluate repeatability of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.

**Field Replicate.** A field replicate consists of a second sample that is collected using the same sampling methodology used to obtain the first sample. It is collected at the same

sampling location and as soon after the original sample as possible. Analysis of the field replicate allows evaluation of the repeatability of field sampling methodologies, as well as the heterogeneity of the sample matrix. Statistical analysis of multiple replicates may also be used to calculate the likely range of an analyte concentration at a given sampling location.

## REFERENCES

David, N., D. Bell, and J. Gold. 2001. Field Sampling Manual for the Regional Monitoring Program for Trace Substances. San Francisco Estuarine Institute, San Francisco, CA.

Integral. 2004. QAPP Addendum for Stormwater Sampling. Prepared for the Lower Willamette Group, Portland, OR. Integral Consulting, Inc., Mercer Island, WA.

EPA. 1996. Method 1669 - Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water Engineering and Analysis Division (4303). Washington, DC.

USGS. 2000. Interagency Field Manual for the Collection of Water-Quality Data. Open-File Report 00–213. U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency. Austin, TX.

# APPENDIX C
# SEDIMENT TRAP SAMPLING SOP

# SEDIMENT SAMPLING AND PROCESSING

The purpose of this standard operating procedure (SOP) is to define and standardize the methods for collecting sediment samples from a catch basin using a sediment trap. A goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow EPA guidelines.

While sampling for trace metals, trace clean sampling techniques will be used for the collection of unfiltered organic compounds. By following this SOP, the collection of other samples besides trace metals guarantees a high level of sample integrity and minimizes potential contamination during sample handling.

# SUMMARY OF METHOD

Sediment samples for standard chemical and conventional analyses will be collected using a sediment trap installed at the outlet of each catch basin. The sediment trap will be deployed for at least three months. The traps will be regularly inspected and sample bottles replaced when they are greater than half full. Samples will be attempted to be collected using the two-person "clean hands – dirty hands" method (EPA 1996), however, do to limited space it may not be possible. The collected samples will be stored in refrigerators at the LWG field lab until the end of the sampling period. All the samples from each site will be composited and distributed to sample bottles for laboratory analysis.

# SUPPLIES AND EQUIPMENT

Generally all the equipment required for the sediment sampling is as follows:

- Sediment sampler constructed of stainless steel.
- 1-Liter Boston Amber sample bottle with Teflon lined lid.

A detailed supply and equipment list is provided in Table 1-1. Additional equipment may be required depending on the sampling location.

# PROCEDURES

## EQUIPMENT DECONTAMINATION

### Sediment Sampling Equipment Preparation

The sediment shall be constructed of stainless steel. Prior to installation it will be cleaned using a scrub brush and lab-grade detergent, then rinsed in tap water, and allowed to dry. The Sample bottles will be provided from the laboratory "Certified Clean" and filled with

DI water (The sample bottles are filled with DI water to prevent them from floating out of the sampler when there is water present in the catch basin)

## SEDIMENT SAMPLE COLLECTION

### Clean Hands/Dirty Hands Technique

Clean hands/dirty hands technique requires two or more people working together. At the field site, one person is designated as "clean hands" (CH) and a second person as "dirty hands" (DH). Although specific tasks are assigned at the start to CH or DH, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both CH and DH wear appropriate non-contaminating, disposable, powderless, nitrile gloves during the entire sampling operation and change gloves frequently, usually with each change in task (wearing multiple layers of gloves allows rapid glove changes).

CH takes care of all operations that involve equipment that comes into contact with the sample, including the following responsibilities:

- Handles the sediment sample bottle
- Prepares a clean workspace

DH takes care of all operations that involve contact with potential sources of contamination, including the following responsibilities:

- Works exclusively exterior to the sampler
- Prepares and operates the sampling equipment
- Handles the tools, such as hammers, wrenches, keys, and locks
- Measures and records the water depths and field measurements.

### Sediment Sampling Procedures

Two persons are needed to conduct the sampling. The following steps are taken in order to set up the sediment collection system and processing of samples:

The DH person and assistant will remove the catch basin/manhole lid and the Isco sampler to provide access to the sediment trap. Using the confined space procedures in Appendix H, the CH person will double glove and enter the catch basin to retrieve the sediment sample. After entering the catch basin the CH person will discard the out gloves and cap the sediment sample bottle with a Teflon lined cap. The CH person will remove the sample bottle and seal it in a double Ziploc bag. The CH person will pass the sediment sample to the DH person, who will pack it a cooler for transport.

The DH person will hand back down a new "Certified Clean" sample bottle that's was filled with DI water at the lab and sealed in a Ziploc. The CH Person will remove the new sample bottle from the Ziploc and place it the sampler. The CH person will then remove the cap from the new sample bottle. The CH person will exit the catch basin and the DH person and assistant shall redeploy the Isco sampler and reinstall the catch basin lid.

## SAMPLE PROCESSING

Once a sediment sample container is properly closed, labeled, and then sealed inside a Ziploc™ bag by the CH person, the DH person seals the second Ziploc™ bag and places it inside a large plastic bag, which in turn is placed inside a cooler containing wet ice.

All samples are stored in sealed coolers with wet ice and transferred to the LWG field laboratory at the conclusion of sampling. Personnel will then transfer the samples to the laboratory. The field leader is responsible for maintaining sample integrity throughout the sampling event. Once at the field lab, sample contamination is avoided by handling the double-bagged sample containers with clean gloves, and transferring the samples into clean refrigerators immediately after samples are brought back from the field.

### Storage Temperature Quality Control

Each storage freezer or refrigeration unit is monitored daily to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

## FIELD QUALITY CONTROL PROCEDURES

Field QC samples that may be collected during sampling are the same as for any field sampling program. The types and frequency of field QC sample collection are project-specific. QC samples are described below (USGS 2000) and will be described in the project field sampling plan. The most commonly collected field QC samples for sediments are field splits and replicates.

**Field Split Sample.** A field split sample consists of aliquots of the same composited sediment sample that are equally distributed in two sets of sample containers. These samples may be analyzed identically or analyzed by different laboratories to evaluate repeatability of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.

**Field Replicate.** A field replicate consists of a second sample that is collected using the same sampling methodology used to obtain the first sample. It is collected at the same sampling location and as soon after the original sample as possible. Analysis of the field replicate allows evaluation of the repeatability of field sampling methodologies, as well

as the heterogeneity of the sample matrix. Statistical analysis of multiple replicates may also be used to calculate the likely range of an analyte concentration at a given sampling location.

# APPENDIX C-2
# STORMWATER FILTERING FOR SEDIMENT COLLECTION (BACK UP PROCEDURE)

# HIGH-VOLUME STORMWATER FILTERING

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of sediments in filter media from high-volume water samples. Samples are collected to quantify sediment concentrations of targeted organic chemicals (e.g., dioxins, PCBs, and pesticides) that are present at that could not be collected with the preferred sampling methods.

A goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow these same guidelines.

## SUMMARY OF METHOD

Large volumes of water will be pumped through glass fiber filter cartridges. This procedure retains particulates on the filters. A total volume of 1,000 liters will be pumped at each high-volume sample station at a flow rate of 1.25 liters per minute.

The water intake will be placed near the outlet of the catch basin with a long pole. Once the required volume for a particular analyte is established, the operator will run the pump at a fixed rate to collect a composite sample by setting the appropriate flow rate. (i.e., 1.25 liters per minute) and then monitor the system during the time period necessary for sample collection. The operator will also monitor the in-line pressure and replace filters when necessary. Samples will be collected using the "clean hand – dirty hand" method. Once the desired volume is pumped, the column assembly will be removed and any residual water will be drained out. The glass fiber filters will be removed as needed and placed in appropriate containers, labeled, placed in a polyethylene bag, and stored in a cooler containing ice.

At the analytical laboratory, filters will be extracted and analyzed individually. Extraction of filters will follow the laboratory SOP, which will be provided as an attachment to the QAPP Addendum for Stormwater Sampling.

## SUPPLIES AND EQUIPMENT

The general types of equipment that are required are described in this section. A detailed supply and equipment list is provided in Table 1. Additional equipment may be required depending on project requirements.

The equipment used for sediment sampling consists of a peristaltic pump and a sample tubing system composed of Teflon™ tubing and Swageloc™ stainless steel fittings. Other than the filters used for sampling particulates, no containers are used for sample collection. Filters for sampling particulates will be prepared in the laboratory.

For each sampling station, glass fiber filters from the laboratory are prepared. The sample intake requires an approximate 4-meter-long Teflon™ tubing. The nominal filter pore size used will be selected in consultation with EPA and its partners prior to mobilizing to the field sampling location. A portable 3000-watt power generator will be used if 120 VAC electricity is not available at the sample site to operate the pump

# PROCEDURES

## EQUIPMENT PREPARATION

Before sample collection begins, sample containers and pre-cleaned glass fiber filters and coolers are cleaned with a mild soap and rinsed with distilled water. Sample containers are labeled with the date, sampling location, and a unique sample identification number using a permanent marker. Once cleaned and labeled, the sample containers are placed in coolers to keep from being contaminated during the sampling event. Date, site location, and sample identification numbers are noted on the field data sheet. A detailed site description with references to landmarks also is also provided.

### Initial Setup

Prior to sampling, a clean Teflon™ intake line is then connected to an intake structure anchored in the stream of flow near the outlet of the catch basin. The discharge from the pump is discharged to the ground surface, down gradient of the intake to prevent mixing of the waste water with the sampled water. The sampling unit can then be plugged into the generator for power.

### Decontamination Procedures

Before sample collection begins, the sampler is completely cleaned and tested for leaks and other mechanical problems. The sampler is cleaned chemically after every sampling day. Clean latex gloves are worn during equipment decontamination. Once equipment has been cleaned, care should be taken to avoid touching or otherwise contaminating any surfaces that will come in contact with the sample water (e.g., inside surface of filter housings). Decontamination procedures are provided for the sampling unit, which also includes the filter housings and Orings, as well as, tongs and forceps.

#### Sampling Unit Decontamination

Decontaminating the sampling unit includes not only the pump unit but also the filter housings and O-rings. Procedures for decontaminating each of these parts are provided below.

- Filter Housings and O-rings
- Remove filter housings from unit.

- Wash housings and O-rings using a scrub brush and lab-grade detergent.
- Rinse housings and O-rings with deionized water. Use cleaned forceps to hold O-rings while rinsing.
- Allow cleaned items to air dry on a clean plastic tarp. Place O-rings in filter housings, and reconnect housings to sampling unit.

**Sampling Unit**

- Plug unit in (generator or wall outlet) and power up the sampling unit using the main toggle switch.
- Check that the flow control valves on top of the unit both point in the same direction. The arrows on the valve handles point to the filter housing that water will be drawn through.
- With the intake line submerged in warm water with lab-grade detergent, press the <ON> button on the control panel to start the pump.
- Increase the RPMs of the pump until the pump is primed and water is flowing through the unit.
- Draw 20 liters of soapy water through the system, followed by 5 liters of deionized water.
- Place the end of the intake line in a wash bottle with approximately 500 mL of acetone. Continue pumping until all of the solvent has been drawn into the tubing.
- Following the acetone rinse, place the end of the intake line in a wash bottle with approximately 500 mL of deionized water.
- Continue pumping until all of the water has been drawn through the tubing.
- Place the intake line into water to be sampled (effluent stream) to push the solvent and deionized water through the unit. Continue pumping water for approximately 1 minute through the filter housing to thoroughly flush the system.

**Tong and Forceps Decontamination**

- Use a scrub brush with lab-grade detergent to thoroughly clean the tongs and forceps.
- Rinse with deionized water, then with a small amount of acetone.

- After cleaning, store the tongs and forceps in a clean storage container until needed. Once used, place the utensils in a separate container used only for contaminated items that need to be cleaned before use.

## SAMPLE COLLECTION

### Clean Hands/Dirty Hands Technique

Clean hands/dirty hands technique requires two or more people working together. At the field site, one person is designated as "clean hands" (CH) and a second person as "dirty hands" (DH). Although specific tasks are assigned at the start to CH or DH, some tasks overlap and can be handled by either as long as contamination is not introduced into the samples. Both CH and DH wear appropriate non-contaminating, disposable, powderless, nitrile gloves during the entire sampling operation and change gloves frequently, usually with each change in task (wearing multiple layers of gloves allows rapid glove changes).

CH takes care of all operations that involve equipment that comes into contact with the sample, including the following responsibilities:

- Handles the glass fiber filters
- Handles the discharge end of the stormwater sample tube or line
- Prepares a clean workspace
- Sets the equipment (i.e., the filtration equipment)

DH takes care of all operations that involve contact with potential sources of contamination, including the following responsibilities:

- Prepares and operates the sampling equipment, including the pumps and discrete samplers, peristaltic pump switch, and pump controller
- Handles the generator or other power supply for samplers
- Handles the tools, such as hammers, wrenches, keys, locks, and sample-flow manifolds
- Handles the single or multi-parameter instruments for field measurements.
- Sets up and checks the field-measurement instruments
- Measures and records the water depths and field measurements.

## Stormwater Sampling Procedures

Two persons are needed to conduct the sampling and a third person to keep track of sample logging and sample processing. Samples are collected using the clean hand – dirty hand (CH/DH) method.

Step 1 – Insert Glass Fiber Filter. Remove one filter housing from unit.

- Insert glass fiber filter into filter housing touching only the plastic wrapper. Do not directly touch any exposed surfaces of the filter. If the exposed filter comes in contact with anything other than the interior of the filter housing, the filter is discarded, and a new filter is used.
- Once the filter is in place, reconnect the filter housing to sampling unit.

Step 2 – Reset Volume Meter

- Press <RESET> on the volume totalizer until the display reads 0.0.

Step 3 – Check Control Unit Settings

- Check the control unit to make sure the RPM light is on. If light is not on, press <STOP/RESET>. -Make sure the FORWARD direction light is on. If the REVERSE light is on, press the <FORWARD/REVERSE> button.
- Make sure the PROGRAM light is NOT on. The pump will not operate in PROGRAM mode. If the PROGRAM light is on, press the <STOP/RESET> button.
- Use the UP and DOWN arrows to control the RPMs. A good initial starting point is 1200 RPMs.

Step 4 – Begin Pumping

- Press <ON> to begin pumping. It may be necessary to increase the RPMs to get the pump started. It takes a few moments to get water flowing through the entire system.
- The moment that water is observed in the post-column line, reset the volume totalizer to 0.0. This is necessary to get an accurate volume measurement, because the totalizer will measure the water that was

already in the lines from the cleaning process even though this water did not pass through the filter.

- Adjust the RPMs until the flowmeter indicates that the unit is operating at the optimum pumping rate of 1.25 liters/minute.
- Check all fittings to make sure there are no leaks.
- Note on the field data sheet the start time, pumping rate, and initial pressure on the system.

Step 5 – Check System

- Check the sampling unit periodically (at least every hour) to ensure unit is operating correctly. Check and record the volume filtered, flow rate, and pressure.
- If the pressure reaches 20 psi, the glass fiber filter must be changed.
- If the flow rate has decreased, increase the RPMs to maintain the optimum pumping rate of 1.25 liters/minute. If increasing the RPMs does not help, the glass fiber filter must be changed.

Step 6 – Complete Sample Collection

- Operate the sampling unit continuously until the desired volume of water has been filtered. For most in-stream samples, 1,000 liters of water are pumped through the system. However, smaller samples may be collected, depending on expected chemical concentrations.
- Once desired volume has been filtered, cease pumping by pressing <STOP> on the control unit.
- Record stop time and volume filtered on the data sheet.
- Turn main switch on unit to off.

**Changing the Glass Fiber Filter**

The glass fiber filter must be changed if the pressure reaches 20 psi, or if adjusting the RPMs does not increase the flow rate, by using the following procedure:

- Insert a glass fiber filter in the unused filter housing as described in Step 1.
- Press <STOP/RESET> to temporarily cease pumping.
- Record the stop time and volume filtered.

- Switch both directional flow valves to point in the direction of the filter housing containing the clean filter.
- Press <START> to resume pumping. See Sample Handling Procedures (below) to remove the used filter from the filter housing.

## SAMPLE HANDLING PROCEDURES

The following procedures describe how the used filters must be handled once sampling is complete.

### Glass Fiber Filters

- Remove the lower filter housing unit while being careful not to spill any of the particulate laden inside.
- Use clean tongs to remove the used filter from the housing and place the filter in a pre-cleaned glass jar. Note that more than a single filter and jar may be required if the sampled water is turbid.
- Add any residual water and particulates from the lower housing to the glass jar containing the filter.
- Label the jar(s) with date and sample ID number.
- Place container on ice in a cooler.
- Record sample identification number on field data sheet.

## SAMPLE PROCESSING

All samples are stored in sealed coolers with wet ice and transferred to the field laboratory at the conclusion of the sampling event. The field leader is responsible for maintaining sample integrity throughout the event. Once at the field lab, sample contamination is avoided by handling the sample containers with clean gloves, and transferring the samples into clean refrigerators immediately after samples are brought back from the field.

### Storage Temperature Quality Control

Each storage freezer or refrigeration unit is monitored daily to ensure temperature compliance. Each unit will have a separate log form containing date, time, and temperature information.

## FIELD QUALITY CONTROL PROCEDURES

Field QC samples that may be collected during sampling are the same as for any field sampling program. The types and frequency of field QC sample collection are project-specific and will be described in the project field sampling plan. The most commonly collected field QC samples are described below (USGS 2000):

**Field Blank.** A field blank is a clean filter that will travel with the sampling team. It will be packed and placed in the coolers with the collected samples for analysis after the sampling event.

**Field Split Sample.** A field split sample consists of aliquots of the same composited sample extract that are equally distributed in two sets of sample containers. These samples may be analyzed identically or analyzed by different laboratories to evaluate repeatability of sample handling and analytical procedures, sample heterogeneity, and analytical procedures.

**Field Replicate.** A field replicate consists of a second sample that is collected using the same sampling methodology used to obtain the first sample. It is collected at the same sampling location and as soon after the original sample as possible. Analysis of the field replicate allows evaluation of the repeatability of field sampling methodologies, as well as the heterogeneity of the sample matrix. Statistical analysis of multiple replicates may also be used to calculate the likely range of an analyte concentration at a given sampling location.

# Appendix D
# Flow Measurements

# FLOW MEASUREMENTS

The purpose of this standard operating procedure (SOP) is to describe the procedures for installation of the Isco Area/Velocity Flow modules. The goal of this SOP is to ensure that the highest quality, most representative data be collected, and that these data are comparable to data collected by different programs that follow these same guidelines.

# SUMMARY OF METHOD

The Model 750 Flow Modules will be installed in the outfall pipe of the selected catch basin when the Isco samplers and sediment traps are installed. The samplers will be programmed to collect flow measurements at 15-minute increments. The flow meters will be continuously operated during the sampling period.

# SUPPLIES AND EQUIPMENT

The equipment consists of a flow meter module, a sensor and carrier bracket to attach the sensor to the outlet pipe.

# PROCEDURES

## EQUIPMENT PREPARATION

The sensor carrier bracket will be installed into the outlet pipe with an expandable ring so that the sensor will be located at the bottom of the pipe. The diameter of the pipe will be measured and noted for programming the Isco sampler. The flow meter sensor will be connected to the carrier and the cable will secured so that when the sampler is installed in the catch basin the cable does not become kinked. The sampler will be turned on and allowed to self check. The installer will enter the programming mode and enter the diameter of the pipe. The installer will measure the depth of water in the pipe and adjust the sampler offset to match the measured value. The sampler will be prepared for the sampling team to install the clean sample bottles and deploy the sampler as described in Appendix A.

## DATA COLLECTION

Data will be downloaded when water quality samples are collected. When the sampler is removed from the catch basin and the cover is removed a Rapid Transfer Module will be plugged in and data collected. The data will not be erased and allowed to overwrite, in case there is a problem downloading the data (The sampler has adequate memory such that there should be capacity to store the entire data record for the sampling period).

Data will be downloaded from the Rapid Transfer Module at the Anchor office and imported into a database using the Isco data management software.

# Appendix E
# Field Forms

Site Reconnaissance Form.
Chain of Custody/Lab Analysis Request

# Appendix F
# Chain of Custody SOP

# CHAIN OF CUSTODY

The sampling team leader or other designated field sample custodian is responsible for all sample tracking and chain-of-custody procedures until sample custody is transferred to the laboratory.

Custody procedures in the field are as follows:

- Record all field and sample collection activities (including sample identification number, collection time and date) in the field logbook. While being used in the field, the logbook remains with the field team at all times. Upon completion of the sampling effort, the logbook should be reproduced and then kept in a secure area.
- Complete a chain-of-custody form whenever samples are being transferred or removed from the custody of field sampling personnel. A sample form is provided in Appendix F. Record each individual sample on the form. Include additional information to assist in sample tracking such as collection date and time, number of containers, and sample matrix. The chain-of-custody may also serve as the sample analysis request form, with the required analysis indicated for each individual sample.
- Sign the form and ensure that the samples are not left unattended unless secured.
- Store, pack, or ship samples as described in the following section. Place the original completed chain-of-custody form in a sealed plastic bag inside the shipping container. A copy is retained by the shipping party.
- Complete a separate custody form for each individual shipping container or a single form for all samples in multiple shipping containers in a single shipment, with the number of containers noted on the custody form.
- Attach completed custody seals to any shipping container that will be sent to the laboratory by delivery service or courier. Delivery personnel are not required to sign the custody form if custody seals are used. Custody seals are used to detect unauthorized tampering with the samples. Gummed paper or tape should be used so that the seal must be broken when the container is opened. The laboratory sample custodian (or other sample recipient) will establish the integrity of the seals.
- The laboratory custodian (or other sample recipient) acknowledges receipt of the samples by signing, dating, and noting the time of transfer on the chain-of-custody form. The condition of the samples and any problems or irregularities (e.g., cracked or broken columns,

loose caps, evidence of tampering) should also be recorded. Return a copy of the completed custody form to the project manger or designated sample coordinator.

The laboratory will designate a sample custodian who is responsible for receiving samples and documenting their progress through the laboratory analytical process. Each custodian will ensure that the chain-of-custody and sample tracking forms are properly completed, signed, and initialed on transfer of the samples. Specific laboratory chain-of-custody procedures should be in writing, included in the laboratory QA plan, and approved prior to beginning sampling and analysis. Laboratory custody procedures should include the following:

- A designated laboratory person initiates and maintains a sample tracking log that will follow each sample through all stages of laboratory processing and analysis.
- The laboratory tracking log includes, at a minimum, the sample number, location and type of storage, date and time of each removal, and signature of the person removing or returning the sample.
- The final disposition of the sample is recorded.

Complete and correct chain-of-custody is essential to ensure and demonstrate sample integrity. Errors in entering information or transferring custody can result in analytical or data reporting errors. Inaccuracies or errors in sample tracking and custody records can compromise data usability, particularly as legal evidence.

Quality control (QC) procedures include the following:

- Allow adequate time to take accurate and complete field records and to carefully complete chain-of-custody forms.
- When possible, work in pairs or more to complete the chain-of-custody form and check for accurate information entry.
- Complete all custody records in ink; errors should be neatly crossed out and corrected and initialed by the person making the change.
- Immediately notify the project manager of any deviation from required custody procedures.

Environmental samples are packed in a manner to reduce the chance of sample breakage, ensure sample integrity, and prevent material leakage and potential exposure to hazardous materials in the event of breakage. Samples are placed in sealed plastic bags and packed

in a sturdy container with adequate packing material to prevent breakage. Ice for XAD columns and filters is included to maintain sample storage conditions. Samples are transported by field personnel or shipped via courier or common carrier. Shipping procedures are in accordance with U.S. Department of Transportation regulations (49 CFR 173.6 and 49 CFR 173.24).

All preserved samples should be shipped as soon as possible after completion of sampling. This minimizes the number of people handling samples and protects sample quality and security.

Upon completion of final sample inventory by the field sample custodian and completion of chain-of-custody, samples are packed as follows:

- Line a small cooler bottom with bubble wrap and place a double 13-gallon bag inside. Use a leak-proof, sturdy cooler that can withstand rough treatment during shipping. The cooler's drain should be securely plugged and sealed with duct tape.
- Place the filter sample jars tightly inside the doubled bag in the shipping container:
  - Use dividers or bubble wrap to separate all filter sample jars
  - Seal large plastic bags with rubber bands or plastic tie
- Fill any empty space in the shipping cooler or box with packing material so that the jars are held securely.
- Place the original completed chain-of-custody form in a sealed plastic bag and place it inside the shipping container. The form should be securely taped to the inside of the cooler's lid.
- If required to meet sample storage requirements, fill the cooler with wet ice or blue ice packs. A temperature blank (provided by the laboratory) should be packed in each cooler.
- Seal shipping containers securely with packing or duct tape.
- If the shipping containers will be transported by anyone other than the person who completed and signed the chain-of-custody form, attach completed custody seals so that the shipping containers cannot be opened without breaking the seal.
- A Fragile label may also be attached to reduce rough handling of the samples.
- Label the shipping container with all appropriate information (name of project, time and date, responsible person and company name, address and phone) to enable positive identification.

Packed containers may be delivered to the laboratory or storage facility by field personnel, courier, or common carrier (FedEx, UPS). However, any outside carrier or courier service must provide a delivery receipt. The carrier or courier must also ensure delivery time, if holding time and storage conditions are critical. Unless arranged in advance, shipping charges should be prepaid by sender to avoid confusion and possible rejection of the package by the laboratory.

The adequacy of handling and shipping procedures is reflected in the condition of the samples upon receipt by the laboratory:

- No jars containing filters are cracked or broken.
- There is no evidence of sample leakage.
- Measuring the temperature of the temperature black indicates that correct storage conditions have been maintained.

The sample custodian or other designated person is responsible for confirming that copies of all shipping documents, completed in full and correctly, are on file.

## REFERENCES

Integral. 2004. QAPP Addendum for Stormwater Sampling. Prepared for the Lower Willamette Group, Portland, OR. Integral Consulting, Inc., Mercer Island, WA.

University of Houston, and TNRCC. 2002. Total Maximum Daily Loads for Dioxins in the

USGS. 2000. Interagency Field Manual for the Collection of Water-Quality Data. Open-File Report 00–213. U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency. Austin, TX.

# Appendix G
# Laboratory Protocol for Extraction and Analysis of Large Volume Water Samples

# Appendix H
# QAPP Addendum

# Appendix I
# Confined Space Health and Safety Plan Addendum

Anchor Environmental L.L.C., has officially accepted the Integral Round 2 health and safety plan (acceptance letter on June 18, 2004); Anchor intends to continue to use it for general health and safety measures. The following sections provide supplemental details of confined space entry policy and procedures.